WARNING

Because of possible shock or fire hazards, connection of this instrument should be performed in compliance with the National Electrical Code (ANSI C1) and/or any other requirements which may be applicable to the user.

Installation, operation, and maintenance should be performed only by qualified personnel.

IMPORTANT NOTICE

The accessories supplied with this unit are an integral part of its operation. The loss, damage or misplacement of the accessories may result in it not being completely operational or usable.
All accessories must be returned to Electro Rent at the termination of the rental period.
Failure to return all accessories complete and in usable condition will result in costs of replacement accessories.

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TM-110390

VOLUME I

OPERATOR'S MANUAL

626-PA-6006
AC NEUTRAL MONITOR

3 MAY 1982

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626-PA-6006 AC NEUTRAL MONITOR

1 INTRODUCTION

This manual provides operating instructions for the 626-PA-6006 AC Neutral Monitor Plug-in, hereinafter referred to as the 6006. The 6006 is designed for installation in the Model 626 Universal Disturbance Analyzer. It is assumed that the reader is familiar with the mainframe information presented in TM-106650.

2 PURPOSE

The 6006 monitors activity on power system neutral lines with respect to earth ground. With thresholds programmed by the user, the 6006 stores, analyzes, classifies and prints out quantative and qualitative disturbance data. Accompanying the data is a printout of time, derived from a highly accurate crystal controlled 24-hour clock in the mainframe. This single channel unit finds application in all distribution systems having a designated neutral conductor and operating below 600Vrms.

The 6006 has a single voltage range that extends from 2Vrms to 50Vrms. It monitors two types of disturbances: power frequency transients and waveform disturbances. Power frequency transients are divided into three display categories: overvoltage, voltage change, and voltage surge. Since voltage on the neutral line is nominally zero with respect to earth ground, lower voltage limits are not used and voltage sag and undervoltage printouts are not generated. Waveform disturbances, identified as "impulses" are sharp deviations of short duration (compared to line frequency) from the normal waveform. The 6006 measures both peak amplitude of impulses and their polarity. When equipped with an option board the 6006 also measures pulse duration and direction of origin.

The threshold value of each type of disturbance, above which detection and printout occur, is operator programmable. Except for an automatic summary printout at the end of each day, disturbance data is normally printed out only when disturbances occur. In an alternate mode, a disturbance data summary printout occurs only at the end of each day. This feature permits long term unattended operation.

The threshold program may be easily altered, using the front panel switches. Cueing indicators adjacent to the programming switches simplify the programming procedure. A back-up program for the plug-in, stored in non-volatile memory at the factory, may always be recalled upon operator demand. Both the program and the disturbance data in the data accumlators may be printed out upon demand.

3 EQUIPMENT CHARACTERISTICS

The 6006 is configured as a plug-in module 6.5" high by 1.25" wide by 10" deep. It is designed for installation in any of the five slots of the Model 626 Universal Disturbance Analyzer. Technical specifications of the 6006 are listed in Table 1.

Table 1. 626-PA-6006 Technical Specifications

Input	2-wire differential Z_{in} = 40 Megohms plus 40 pf (each side to ground)
Voltage Range	2 - 50V RMS 45 - 64 Hz
User-set Upper Limit Voltage	3 - 30V RMS
Voltage Change Sensitivity (1V increments)	1 - 9 volts
Line Voltage Measurement Accuracy	±1% of reading, ±0.2% of F.S. at calibration frequency of 50 or 60 Hz. Additional ±1% at frequency extremes.
Impulse Ranges (Determined by Impulse Threshold Selection)	25 - 1000 V for 25 to 100V thresholds 101 - 2000V for 101 to 200V thresholds 201 - 4000V for 201 to 4000V thresholds
Impulse Duration Range	2 mSec to 1 μ Sec for amplitude information only.
Impulse Threshold	25 - 4000V in 1 volt increments.
Impulse Amplitude Accuracy	±5% of reading ±1% F.S. for half-sinewave impulses 10 uSec in duration regardless of polarity. Error increases to ±10% of reading, ±1% F.S. at 5 uSec and 50 uSec pulse durations, and is typically -6dB at 2 mSec and 1 uSec pulse durations.

4 INSTALLATION

To install the 6006 in the mainframe, proceed as follows:

CAUTION: Be sure unit is turned off.

a. Position the top and bottom rear corners of the plug-in module in the upper and lower tracks at the desired slot position at the rear of the mainframe.

b. Carefully slide the module into the mainframe until it is firmly seated.

c. Tighten the top and bottom captive screws to secure the module to the mainframe.

5 CONNECTING POWER SOURCE TO MODULE

The 6006 is supplied with a barrier type terminal strip under a small cover (626-PA-6006-1) or with a two pin connector (626-PA-6006-2) located at the rear of the module. Proceed as follows:

a. Insert key in FUNCTION key switch on front panel of mainframe and set switch to OFF position.

b. Turn off AC power to the line that is to be monitored.

c. Remove the terminal strip safety cover to expose the connections. Now connect the neutral line and earth ground to the two terminals as marked. When all connections have been made, be sure to replace the terminal block cover, then reapply AC power.

d. If a two pin connector is installed on the rear panel of the 6006, the AC source to be monitored should be wired to the cable assembly (DEL #110495-G1) supplied with the module. If the supplied cable is not adequate the mating two pin connector can be obtained from AMP, Inc. The part numbers are as follows:

Part Number	Description
1-480698-0	CONNECTOR HOUSING
1-640-714-0	STRAIN RELIEF
350689-1	SOCKET CONTACTS

Attach wired mating connector to the rear panel connector then reapply AC power.

WARNING: Because of possible shock or fire hazards, connection of this instrument should be performed in compliance with the National Electric Code (ANSI C1) and/or any other requirements applicable to the user.

Installation, operation, and maintenance should be performed only by qualified personnel.

CAUTION: To avoid damaging the equipment, do not apply AC voltages in excess of 600V RMS to the 6006.

6 OPERATING THE 6006

6.1 Operating Controls and Indicators

The functions of the mainframe operating controls and indicators associated with 6006 operation are described in Table 2. Figure 1 shows the typical front panel controls on a Model 626. For a description of controls common to overall Model 626 operation, refer to TM-106650.

6.2 Programming Procedure

Assume it is desired to program a high limit of 20V, a voltage sensitivity of 2 volts, and an impulse sensitivity of 75V. Sensitivity sets the deviation from the present value above or below which a detected value produces a recorded disturbance.

Impulse ranges are set up automatically in accordance with pulse sensitivity selected. Thus, selection of an impulse sensitivity of 75V automatically produces an impulse range of 25 to 1000V (See Table 1).

Table 2. 6006 Operating Controls

Item	Function
HI LIMIT pushbutton	When depressed, enables numeric keyboard to program high limit voltage.
SENS pushbutton	When depressed, enables numeric keyboard to program voltage sensitivity value.
IMP SENS pushbutton	When depressed, enables numeric keyboard to program impulse voltage sensitivity value.
ENTER pushbutton	When depressed, transfers numeric keyboard value into the 6006 memory.
DATA pushbutton	When depressed, produces data summary printout. (Functions in operate mode only.)
PROG pushbutton	When depressed unit prints time and a summary of the program (threshold settings) in each channel in sequence (1-5). (Functions in operate mode only.)
PRESET pushbutton	With FUNCTION switch set to PROGRAM and a channel switch (1-5) depressed, depressing PRESET switch recalls non-volatile factory program for that channel.

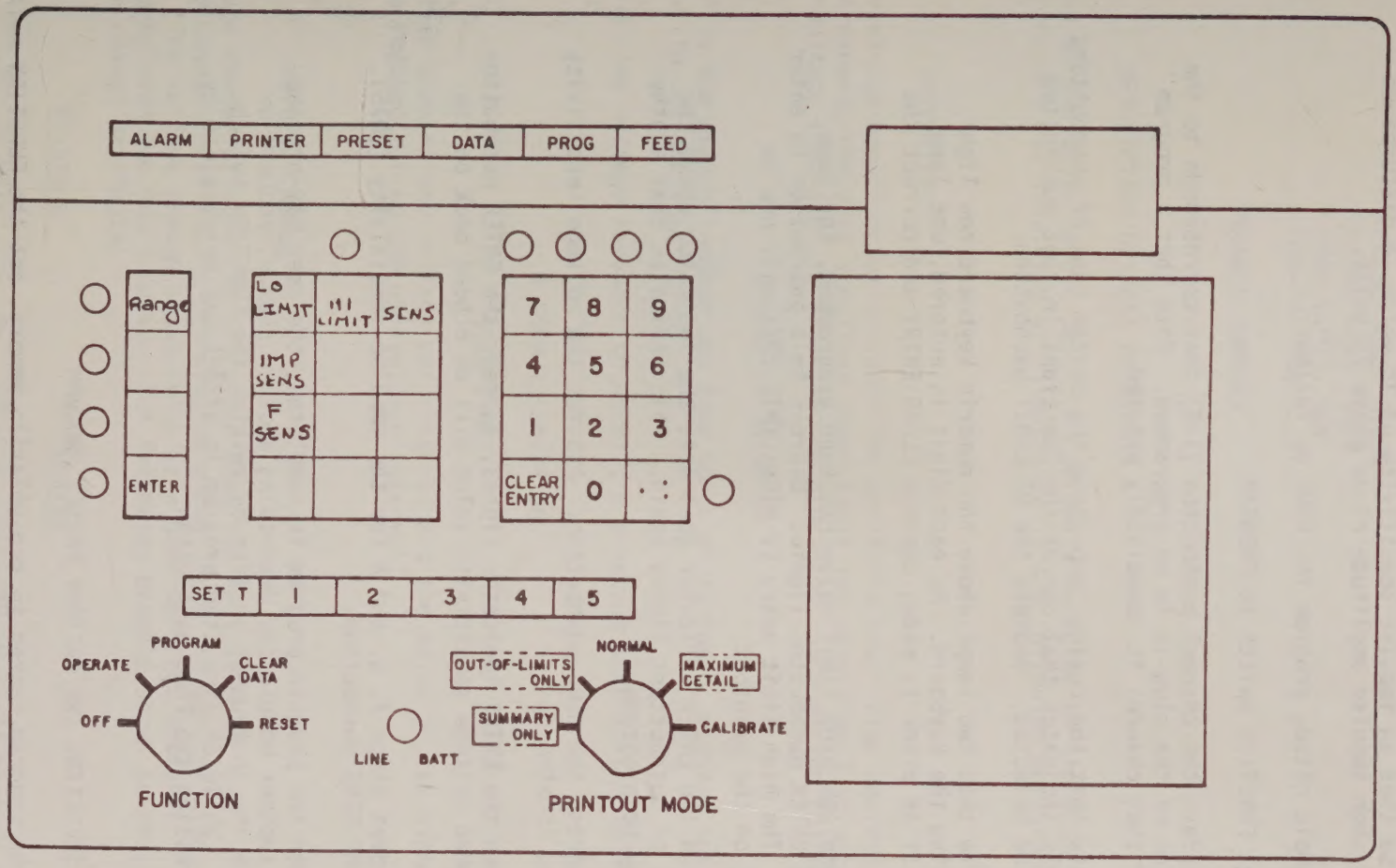


Figure 1. Typical Front Panel of Model 626

For impulse measurements, the sensitivity corresponds to the absolute threshold, so that an impulse sensitivity of 75 volts, a disturbance is recorded when impulse amplitude rises above 75 volts.

For the example cited, program the 6006 as follows:

a. Set FUNCTION switch to PROGRAM.

b. Depress the channel pushbutton (1-5) that corresponds to the slot position of the plug-in to be programmed. Note that a program summary for that channel is immediately printed.

c. Note that the cueing lamp above the center bank of pushbuttons lights. This indicates that one of the functions in that pushbutton bank is to be selected. Depress the HI LIMIT pushbutton.

d. Note that two lamps above the numeric keyboard now light. Enter 20 using the keyboard. As each digit is entered, one lamp goes out. If an error is made, depress CLEAR ENTRY and correct the entry.

e. When the high limit value has been programmed, the lamp next to the ENTER pushbutton lights. Depress this pushbutton to enter the value. The high limit entry (V HIGH LIMIT 20V) will now be echoed back on the printout.

f. When the ENTER indicator goes out, the indicator above the center bank of pushbuttons lights again. This indicates that another function may be programmed.

g. Depress the SENS pushbutton. Program the voltage sensitivity value (2) as in step d.

h. When the ENTER indicator lights, depress the ENTER pushbutton. The programmed voltage sensitivity value will be echoed back on the printout.

i. Repeat steps f, g, and h for the impulse sensitivity (0075), using the IMP SENS pushbutton.

j. When the plug-in program is completed, the user may proceed to program another module (by depressing another channel number) or he may place the instrument on line by setting the FUNCTION switch to OPERATE. While on line, the program in effect may be obtained by simply depressing the PROG pushbutton.

7 SELECTING THE FACTORY PRESET PROGRAM

To select the program stored in non-volatile memory, set the FUNCTION switch to PROGRAM and depress the channel number desired. The last operator-set program will be printed out. Now depress the PRESET pushbutton to recall the factory-set program. Unless specially modified to customer requirements, the factory-set program for the 6006 is as follows:

IMPULSE SENS 0100V
VOLTAGE SENS 002V
V HIGH LIMIT 05V
626-PA-6006
CH 1
PROGRAM SUMMARY

8 DESCRIPTION OF DATA PRINTOUTS

When any of the disturbances described below is detected by the 6006, it is recorded and displayed as illustrated in the following paragraphs.

8.1 Overvoltage

An overvoltage condition exists when the monitored power line neutral voltage exceeds the user specified upper limit for more than 2.55 seconds An overvoltage condition is indicated by a printout such as the following:

4 HIGH 12:34:56.78

where 4 is the channel number and time is given in hours, minutes and seconds (to .01 sec resolution).

When the line voltage recovers to normal, a printout such as the following occurs:

4 NORM 12:36:14.56

35.8 V MAX

indicating when normal voltage was restored and the value of the highest voltage reached during the overvoltage interval.

8.2 Voltage Change

A voltage change printout is triggered when the neutral to ground voltage changes more than a preselected amount from the last printed value. The voltage change sensitivity is a user selected integral voltage between one and 9 volts. The following example shows several voltage change printouts:

Printout	Remarks
2 INC 01:02:34.58	Voltage increased to 15.4V at time shown
15.4V	
2 DEC 01:02:34.56	Voltage decreased to 9.2V at time shown
9.2V	

8.3 Voltage Surge

A Voltage Surge is defined as a line voltage which increases through a user-selected upper limit and then returns to an in-tolerance condition in less than 2.56 seconds. When a surge begins, its starting time is printed as follows:

```
3   HIGH   12:34:50.49
```

When the line voltage returns to a normal level following a Surge condition, a message such as the following will be printed:

```
3   NORM   12:34:51.59
    35.2 V MAX
    SURGE 1.10 SEC
```

In this case, the time at which the voltage returned to normal is shown as well as the maximum voltage reached and the surge duration.

8.4 Impulses

'Impulse' disturbances represent any line perturbation which contains frequency components in the 300 Hz to 500 kHz range. An impulse type disturbance produces a printout such as the following:

```
2 IMP 10:12:13.45
  +0139 V PK
```

This printout indicates that an impulse which deviated from normal neutral line voltage by +139 volts peak was detected on channel 2 at the time shown. The "+" indicates the impulse was positive with respect to the ground terminal on the rear panel of the 6006.

9 PRINTOUT MODES

The setting of the PRINTOUT MODE switch on the front panel of the mainframe determines how much detail is printed out. Printout data is reduced as the switch is rotated counterclockwise.

The following example printouts show how various settings of the PRINTOUT MODE switch change the amount of detail in the printed record of a disturbance. It is assumed that the disturbances occurred in Channel 1 and that the limits for Channel 1 were programmed as follows:

```
V HIGH LIMIT      20 Vrms
V SENSITIVITY      2 Vrms
```

The example printouts are referenced to figure 2 which illustrates an overvoltage disturbance.

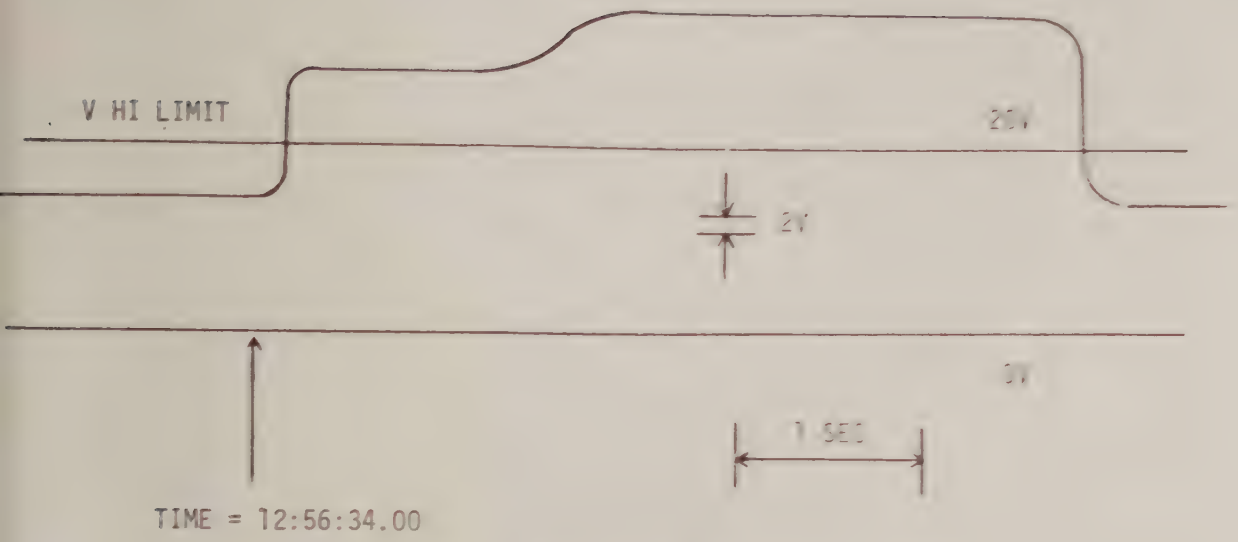


Figure 2. Overvoltage Disturbance (6006)

Disturbances which occur while the PRINTOUT MODE switch is in the SUMMARY ONLY position do not generate individual printouts but they are stored in the daily accumulator and are automatically printed each day at midnight (worst case event and number of occurrences in each category). This printout may also be triggered manually by depressing the DATA button.

```
1 NORM 12:56:38.51
  34.1 V MAX

1 HIGH 12:56:34.21
```

Printout of overvoltage (fig. 2) in OUT-OF-LIMITS ONLY mode.

```
1 NORM 12:56:38.51
  34.1 V MAX

1 DEC 12:56:38.50
  25.2 V

1 INC 12:56:35.78
  32.3 V

1 INC 12:56:35.62
  30.3V

1 INC 12:56:35.40
  28.3 V

1 INC 12:56:34.22
  26.3 V

1 INC 12:56:34.21
  24.2 V

1 HIGH 12:56:34.21
```

(Read Up)

Printout of overvoltage (fig. 2) in NORMAL mode.

1 DEC 12:56:38.61
14.8 V

1 DEC 12:56:38.53
16.8 V

1 DEC 12:56:38.51
19.0 V

1 NORM 12:56:38.51
34.1 V

1 DEC 12:56:38.50
25.2 V

1 INC 12:56:35.78
32.3 V

1 INC 12:56:35.62
30.3 V

1 INC 12:56:35.40
28.3 V

1 INC 12:56:34.22
26.3 V

1 INC 12:56:34.21
24.2 V

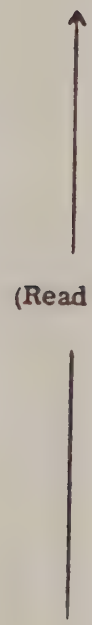
1 HIGH 12:56:34.21

1 INC 12:56:34.20
16.1 V

1 INC 12:50:12.34
14.0 V

(Read Up)

Printout of overvoltage (fig. 2) in MAXIMUM DETAIL mode



(Read Up)

1 DEC 12:56:38.61
14.8 V

1 DEC 12:56:38.53
16.8 V

1 DEC 12:56:38.51
19.0 V

1 NORM 12:56:38.51
34.1 V

1 DEC 12:56:38.50
25.2 V

1 INC 12:56:35.78
32.3 V

1 INC 12:56:35.62
30.3 V

1 INC 12:56:35.40
28.3 V

1 INC 12:56:34.22
26.3 V

1 INC 12:56:34.21
24.2 V

1 HIGH 12:56:34.21

1 INC 12:56:34.20
16.1 V

1 INC 12:50:12.34
14.0 V

Printout of overvoltage (fig. 2) in MAXIMUM DETAIL mode

9.1 Calibrate

When the Printout Mode Switch is set to CALIBRATE, a source of precise signals is applied to the front end circuitry of the 6006. Any inputs that are connected at this time will be automatically disconnected for the calibration period. These calibration signals fully verify the functionality of the module. The calibrate signals, and the allowable tolerance levels are described below.

9.2 Calibrate Signal Levels

Impulse: +160V pk
Voltage: 30.0V RMS

9.3 Calibrate Signal Tolerances

Impulse: +134 to +186V pk
Voltage: 29.6 to 30.4V

10 626 MODULE CAPACITY

The 626 standard mainframe has an upper limit of the total load rating of the installed modules. The overall mainframe capacity is set at 13 units, and individual modules have load ratings as follows:

Plug-in	Load Rating
626-PA-6001	2 Units
626-PA-6001 With Extra Option Board	3 Units
626-PA-6002	2 Units
626-PA-6003	4 Units
626-PA-6006	2 Units
626-PA-6006 with Extra Option Board	3 Units
626-PA-6007	1 Unit
626-PA-6011	1 Unit
(626-PA-6012)	3 Units

When selecting modules for installation in any mainframe, simply verify that the sum of the load ratings of the installed modules does not exceed 13.

11 STANDARD ACCESSORIES

Model No.	Part No.	Quantity	Description
626-PA-6006-1	TM-110390 Vol. I	1	Operator's Manual
626-PA-6006-2	TM-110390 Vol. I	1	Operator's Manual
626-PA-6006-2	110495-G1	1	Input Cable with Tinned Leads

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